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J. H. Stewart

Horace Atwood

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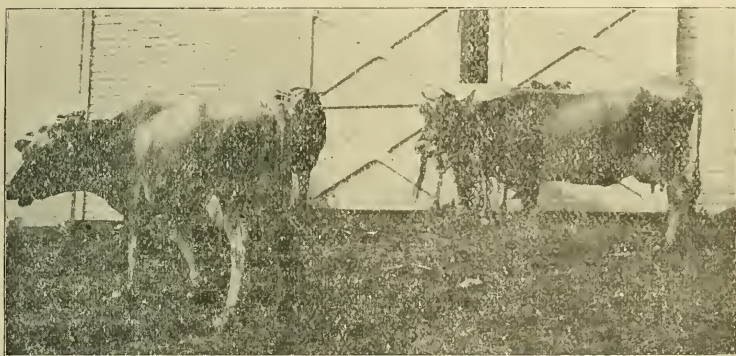
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AGRICULTURAL EXPERIMENT STATION
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Feeding Grain to Milch Cows at Pasture



By J. H. STEWART and HORACE ATWOOD

(The Bulletins and Reports of this Station will be mailed free to any citizen of West Virginia upon application. Address, Director of Agricultural Experiment Station, Morgantown, W. Va.)

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FEEDING GRAIN TO MILCH COWS AT PASTURE.

The conditions surrounding the dairy business in parts of West Virginia are somewhat peculiar. Owing to the rapid industrial development of the State there are many cities and towns in which the population has increased so rapidly that the surrounding country has been unable, at least temporarily, to supply adequate quantities of agricultural products. This is especially true of milk, cream, butter and cheese. In fact there is practically no cheese, and but little creamery butter made anywhere in the state, and the supply of milk and cream for direct consumption is so inadequate that cities even as far in the interior as Grafton and Clarksburg are obliged to send to Ohio for a portion of their supplies. As a consequence first-class dairy products rule high in price.

Although West Virginia possesses large areas of limestone soil on which blue grass thrives to perfection, yet in the coal fields, which comprise approximately one-half of the area of the State and where most of the industrial development is taking place, the pastures, in general, are not particularly luxuriant. In the latter part of the summer, especially, they are apt to become dry and parched, and it is a matter of much practical importance how to keep up the milk flow at that season of the year. For this purpose the practice may be adopted of feeding either grain or soiling crops to supplement the pasture. Is either one of these practices profitable, or both? If soiling crops and grain can both be fed to advantage in the summer time, which is the more profitable of the two, or should grain be used in connection with soiling crops for the very best results?

In order to begin the study of these practical problems an experiment has been performed during the past summer in which twelve cows of the station herd have been employed. They were mostly Jerseys or Jersey grades, except numbers 19 and 20 which were Jersey-Ayrshire heifers with their first calves and with the exception of these two most of the other cows had been several months in milk.

The cows were divided into two lots as nearly similar as possible in milk flow, in age, in length of time they had been in milk, and in length of time until next calving. For periods of two weeks one lot of cows received grain, and the other lot did not receive grain. Then the conditions were reversed and the lot which had not been receiving grain was fed grain, and the other lot no grain, and so on. Three tests were made. The first began June 13th, the second July 10th, and the third August 8th. Each test was continued for twenty-eight days.

The grain employed was "Sucrene," one of the proprietary dairy feeds. It had a guaranteed composition of 16.5% protein, 3.5% fat, and cost twenty-five dollars per ton delivered at the farm. Six pounds of this were fed daily to each cow, when receiving grain, the amount being divided into two feeds of three pounds each.

TEST I.

During the time covered by this test, June 13th to July 10th, the pasture remained fresh and green and there was plenty of grass available for the cows. The following table shows the number of pounds of milk given by each cow, with, and without grain, during each of the two fourteen day periods.

YIELD OF MILK. TEST 1.

Cow	Period 1.		Period 2.	
Number.	With Grain.	Without Grain.	With Grain.	Without Grain.
1....	420.5	.....	.....	353.
6....	554.25	.....	.....	442.75
7....	457.75	.....	.....	361.25
8....	439.50	.....	.....	338.50
10....	268.25	.....	.....	244.25
20....	305.50	.....	.....	261.50
3....	.....	330.50	339.	.....
5....	.....	270.50	247.25	.....
9....	.....	475.	469.25	.....
17....	.....	307.	354.75	.....
18....	.....	391.25	300.75	.....
19....	.....	348.	319.50	.....
Total..	2445.75	2122.25	2030.50	2001.25
			2445.75	2122.25
Total production, with, and without grain			4476.25	4123.50

During the twenty-eight days the cows, when receiving grain, produced 4476.25 pounds of milk, and when not receiving grain the same cows produced 4123.50 pounds, leaving a balance of 352.75 pounds of milk due to the grain feeding. This is practically equivalent to 164 quarts. For this increased milk production six pounds of grain were fed daily to each of six cows for twenty-eight days, or a total of 1008 pounds of grain costing twelve dollars and sixty cents. This made the extra milk production cost at the rate of 7.6 cents per quart.

The weight of the cows. The cows were weighed at the beginning of the test and at the end of each period. The results of the different weighing are brought together in the following table.

WEIGHT OF COWS. TEST 1.

Cow Number.	Beginning of test.	End of first period.		End of second period.
		With Grain.	Without Grain.	
1....	710	735	740	
6....	695	690	690	
7....	850	830	790	
8....	940	965	980	
10....	840	860	845	
20....	605	645	690	
Total..	4640	4725	4735	
		Without Grain.	With Grain.	
3....	710	705	715	
5....	825	850	875	
9....	800	800	810	
18....	580	580	595	
17....	780	780	805	
19....	640	660	680	
Total..	4335	4375	4480	

Lot one which received grain during the first period gained 85 pounds, and without grain during the second period 10 pounds. Lot two without grain during the first period gained forty pounds and with grain during the last period 105 pounds. The larger increases in live weight in both cases were made when the cows were receiving grain.

TEST II.

This test began July 25th, and was finished August 21st. Although the rainfall was fairly abundant during this test yet the grass became short affecting both the yield of milk and the weight of the cows. The following table shows the milk yield.

YIELD OF MILK. TEST 2.

Cow Number.	Period 1.		Period 2.	
	With Grain.	Without Grain.	With Grain.	Without Grain.
1....	289.	.....	.....	232.75
3....	288.25	.....	.....	254.75
7....	294.	.....	.....	253.
9....	351.50	.....	.....	309.25
15....	288.25	.....	.....	254.50
20....	197.	.....	.....	148.25
2....	.....	276.25	295.50	.....
4....	.....	261.50	288.50	.....
6....	.....	274.50	297.25	.....
10....	.....	176.75	162.25	.....
14....	.....	256.25	266.75	.....
17....	.....	221.	233.	.....
<hr/>				
Total..	1708.	1466.25	1543.25	1452.50
			1708.	1466.25
Total production with and without grain			3251.25	2918.75

The increased yield due to feeding the grain amounted in this test to 332.5 pounds or practically 155 quarts of milk. As the grain cost twelve dollars and sixty cents in this test also, the increased milk production cost 8.1 cents per quart.

The following table shows the weight of the cows during this test.

WEIGHT OF COWS. TEST 2.

Cow Beginning of test. End of first period. End of second period.

Number.		With Grain.	Without Grain.
1....	745	740	720
3....	730	750	725
7....	755	770	760
9....	810	820	800
15....	750	730	730
20....	690	685	670
	<hr/>	<hr/>	<hr/>
Total..	4480	4495	4405
		Without Grain.	With Grain.
2....	825	785	750
4....	760	700	680
6....	685	680	665
10....	380	860	880
14....	990	955	930
19....	680	670	665
	<hr/>	<hr/>	<hr/>
Total..	4820	4650	4570

During the first period lot 1 increased in live weight 15 pounds, while lot 2 fell off 170 pounds. During the second period both lots increased somewhat in weight, those which had received grain losing slightly less than the others.

TEST III.

This test covered the period from August 22d, to September 18th, both inclusive. During this interval there fell only 1.66 inches of rainfall, and the grass in the pasture became so short that it was necessary to supply additional forage. This was provided in the form of cowpeas. These were cut as required, and a small amount scattered daily in the pasture. The peas were of poor quality, being very weedy, and no record was kept of the amount fed as it was impossible to estimate accurately the weight of the weeds rejected.

The following table shows the number of pounds of milk produced during the test.

MILK YIELD. TEST 3.

Cow Number.	Period 1.		Period 2.	
	With Grain.	Without Grain.	With Grain.	Without Grain.
1....	244.75	.....	.....	209.50
3....	250.50	.....	.....	210.50
7....	273.50	.....	.....	180.75
9....	325.75	.....	.....	258.
15....	270.	.....	.....	230.
20....	163.50	.....	.....	133.50
2....	.....	317.	318.	.....
4....	.....	309.50	312.50	.....
6....	.....	269.50	246.	.....
10....	.....	133.25	98.	.....
14....	.....	247.50	227.	.....
19....	.....	204.	183.50	.....
Total..	1528.	1480.75	1385. 1528.	1222.25 1480.75
Total production with and without grain				2913. 2703.

In this case the increased milk production due to the feeding of the grain amounted to 210 pounds or 98 quarts of milk, and as the grain cost the same as in the former test this increased milk production cost nearly 13 cents per quart.

The following table gives the weight of the cows during this test.

WEIGHT OF COWS. TEST 3.

Cow Number.	Beginning of test.		End of first period.		End of second period.	
			With Grain.		Without Grain.	
1....	720		760		735	
3....	725		740		740	
7....	760		770		745	
9....	800		825		810	
15....	730		760		755	
20....	670		690		660	
Total..	4405		4545		4445	
			Without Grain.		With Grain.	
2	750		800		765	
4....	680		725		730	
6....	665		675		660	
10....	880		875		885	
14....	930		950		960	
19....	665		645		675	
Total.	4570		4670		4675	

During the first period in this test the cows that received grain increased in weight 140 pounds, and those without grain 100 pounds. In the second period those without grain lost 100 pounds in live weight, while those receiving grain gained five pounds.

SUMMARY.

This experiment clearly shows that there was no direct financial gain in feeding the grain to the cows while at pasture. It is true that the cows which received grain were uniformly in somewhat better flesh than those that did not receive grain, but as far as the milk yield was concerned the increased flow was produced at an actual loss. It is possible that some other feeding stuff than that employed might have given better results, but the cows seem to relish the "Sucrene" and it is probably that as good results were obtained as would have been obtained by employing the feeds more generally used.

It is interesting to bring together the results of experiments that have been performed at other institutions in feeding grain to cows at pasture, and as these experiments are few in number a brief resumé is made of them.

CORNELL EXPERIMENT STATION, BULLETIN 13.

In this test 6 cows were employed mated as nearly alike as possible in two lots. Lot 1 received only the grass in the pasture, lot 2 besides the pasture, received a grain ration consisting of two pounds of cotton seed meal and two pounds of wheat bran per cow per day. The pasture was almost entirely blue grass on a dry gravelly upland soil, and because of the frequent and heavy rains remained plentiful and luxuriant during the whole course of the experiment. The period of feeding extended from June 8th to September 21st, 1899, or for fifteen weeks.

As the test progressed there was a steady and constant diminishing in the flow of milk of both lots, but lot 2 fell away in their milk much more rapidly than lot 1. At the same time, the milk of lot 2 showed a constant and considerable increase in percentage of fat, while that of lot 1 remained very nearly station-

ary. There was very little difference in the total amount of fat produced by the two lots of cows.

"In this trial we certainly obtained no return in milk or butter for the extra grain fed; but we should want to repeat the trial with other and larger numbers of cows in other seasons and on other pastures before we should consider the matter as at all settled. At present all the other data we have on the question is found in the report of an experiment made at the Kansas Agricultural Experiment Station in the Summer of 1888, and the results so far as they go are in accordance with ours."

In this experiment two lots of cows each were fed alternately on rations consisting of pasture alone, pasture and bran, pasture and corn-meal, and pasture and ground oats, for periods of seven days each. Prof. Shelton from a most careful study of the milk and butter product obtained from these rations extending over a considerable period of time concludes: "The lesson plainly taught is that the grain in the case of corn-meal, bran and oats was fed at a considerable loss. The grain feed added materially to the milk yield, corn-meal showing the greatest increase; but this grain did not nearly pay expenses."

CORNELL EXPERIMENT STATION, BULLETIN 22.

In this test 6 cows were divided into two similar lots of three each. Lot 1 was fed no grain, and lot 2 received a grain ration the same in amount and character as they had been getting during the winter and spring on dry feed. It was made up of a mixture of two hundred pounds of wheat bran, one hundred fifty pounds of cotton seed meal and fifteen pounds of malt sprouts. Of this mixture, cows number one and two (of lot 2) ate nine pounds per day, and cow number three six pounds per day at two equal feeds. The experiment was commenced on May 25, at which time the cows were turned from winter feed on to rich pasture, and the test was continued to September 17, or eighteen weeks.

"It will at once be seen that, as in 1899, we received no return in the production of butter fat from the grain fed. In the

whole period we have one and fifty-eight hundredths pounds per cow or about four and three quarter pounds in all to show for the consumption of 2822 pounds of wheat bran and cotton seed meal by lot 2. The manurial value of the grain fed and the saving in the amount of pasture consumed by the grain fed cows would amount to considerable but not enough by far to counterbalance the extra cost of the grain ration."

As the test progressed the decrease in the milk yield was slightly less in the case of the grain fed lot. These averaged to give .65 pounds of milk per day more than those which received only pasture. The cows which received grain and pasture averaged to gain 77 pounds each in live weight while those which received only pasture suffered an average loss of 37 pounds each.

"Besides the experiment detailed above a similar one was carried on at the same time in which the cows were kept in the barn, and the grass cut and fed to them. For this experiment there were also two lots of three cows each. The experiment was begun on May 21st, and lasted for five weeks, and the grain ration was the same as in the experiment described above.

"When the grass was so succulent that the cows having no grain would eat more of it than those having grain, the milk and butter yield remained constant in both lots. When the grass became so hard that those having no grain would eat no more than the ones having grain, the grain-fed lot forged ahead in milk and butter production. But in neither case was the grain fed at a profit, for in the first case a feed of nine pounds of an expensive grain mixture only resulted in a saving of seven and one-half pounds of fresh grass. There was received in the whole period not quite 47 pounds of butter fat to show for a consumption of nine hundred and sixty-two pounds of grain; but the grain fed lot were giving a little more than a pound of butter fat per cow per week at the beginning, which alone in the five weeks would account for fifteen pounds of this difference. Perhaps the most marked effect in this trial was the way in which the grain fed cows maintained their flow of milk as the grass grew harder."

The conclusion which was drawn at the close of this investigation was as follows:

"In two trials in two seasons we have received no return in milk and butter from feeding a grain ration to cows on good pasture."

"In one trial with cows soiled on fresh grass we have received in increased milk and butter production and in saving of grass consumed, barely enough to pay for the cost of the grain ration added."

"In neither case has any allowance been made for the increased value of the manure when grain is fed, which would be considerable in amount but exceedingly difficult to estimate with exactness."

CORNELL EXPERIMENT STATION, BULLETIN 36.

The objection had been raised in regard to the experiments previously performed in feeding grain to cows at pasture that the pastures were so rich and the cows so well fed that they did not show the best results from the grain feeding in the summer time, and it was determined to transfer the experiment to another herd where the practice had not hitherto been to feed grain in the summer, and where the pastures were not, at least more luxuriant, than upon the large proportion of farms in the State. In short, to select a herd and conditions that should more nearly represent average conditions of the State, than did the University herd. A herd was finally selected which was composed of Jerseys and Jersey grades and which was quite uniform in general characteristics.

The practice had been to feed no grain in the summer and only a moderate grain ration in the winter time. The pasture, a large one, was upland soil and rather light in character and the grasses not luxuriant.

The herd was divided into two similar lots of eight each. The test was begun on May 23d, and was continued for 22 weeks. During this time lot 1 received four quarts per cow per day of a mixture of two parts corn-meal, one part wheat bran, and one part cotton-seed meal by weight. It was fed in two feeds night and morning, when the cows were brought in to be milked. On

August 10, the pastures having become dry, both lots began to receive a ration of green corn fodder of about sixteen pounds per cow per day. On September 9th, the corn fodder ration was changed to millet which continued until October 1st. when second growth grass was used; this continued until October 13th, when pumpkin began to be fed.

The amount of grain consumed by lot one during the course of the experiment was thirteen hundred pounds of wheat bran, thirteen hundred pounds of cotton seed meal, and twenty-six hundred pounds of corn-meal.

During the test the cows which received grain gave an average milk yield of 18.4 pounds per cow per day, while those on pasture alone produced only 14.4 pounds. The percent of fat in the milk was about the same in both cases being 4.67 percent in the case of the lot fed grain and 4.7 percent for the lot fed pasture only.

The addition of the supplementary fodders or the change from one to the other had practically no influence upon the milk yield. The percentage of fat increased from the time the experiment began until the cows had reached their maximum milk production; from this time on there was more or less variation in the two lots until towards the close of the experiment when the general tendency was constantly toward a higher percentage of fat.

There was a constant and well marked increase in the milk yield of lot one, which received the grain. This increase was brought about almost wholly by the more rapid increase in the yield of milk during the early part of the season when the pastures were at their best. This increased milk yield amounted to almost exactly five thousand pounds of milk for the eight cows during twenty-two weeks. The important question, of course, was, did this amount of milk pay for the increased cost of feed. The grain at present prices (1906) would have cost about \$71.50, making the increased milk yield cost slightly more than three cents per quart. Where milk is retailed at 5 or 6 cents per quart

grain feeding, as in this case, would be a paying proposition. The lot fed grain gained, on an average, 53 pounds more in weight during the test than those without grain.

CORNELL BULLETIN 97.

This experiment was a continuation of the test described above. Since the lot fed grain gained 53 pounds more in live weight per cow than the lot receiving no grain the question arose whether this increased gain in live weight would have any influence on the flow of milk during the following year. Accordingly the weight of milk produced by each cow that still remained in the herd was recorded for six months beginning April 1st, 1892.

"From this table may be seen that for six months, beginning with April of the season following that in which the grain was fed, the lot which received the grain gave 480.2 pounds of milk per cow more than did the lot receiving no grain. This gain represents an increase of a trifle more than 16 per cent in favor of the grain fed lot. It seems reasonable to assume that this increased production was due to the grain fed the preceding year, especially in the case of the younger animals. Indeed it was plainly evident that the grain fed two-year-olds and three-year-olds developed into better animals than their stable mates having no grain."

THIRTEENTH ANNUAL REPORT OF THE MISSISSIPPI EXPERIMENT STATION.

In this test the cows were divided into two lots, with three cows in lot one, and six cows in lot two. The test began April 6th and lasted twelve weeks. For the first six weeks all of the cows in both lots received four pounds of cotton seed meal and six pounds of wheat bran per day. During the last six weeks lot 1 received no grain ration and lot 2 was fed three pounds of cotton seed meal and four pounds of wheat bran.

"Owing to the continued rains and the influence of the horn-fly on the herd during the latter half of this experiment all of the cows decreased in the flow of milk, but there is very little difference in the yield of those receiving no grain and the lot given such feed. This indicates that so far as the yield of milk is concerned, it will not pay to feed grain to cows running on good pastures."

GENERAL SUMMARY.

The results of our own experiments and those conducted elsewhere seem to show that unless dairy products are especially high in price it is not a profitable practice to feed grain to cows at pasture. It is true that more milk is obtained and the cows hold up their yield better and remain in better flesh when receiving the grain rations, but under ordinary circumstances there is no direct profit from the grain feeding, as the increased production usually cost more than it can be sold for.

